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ATENT COOPERATION TREATY

PCT

NOTIFICATION OF THE RECORDING
OF A CHANGE(PCT Rule 92bis.1 and
Administrative Instructions, Section 422)

From the INTERNATIONAL BUREAU

To:

MOLYNEAUX, Martyn W.
Langner Parry
52-54 High Holborn
London WC1V 6RR
ROYAUME-UNI

Date of mailing (day/month/year) 27 July 2000 (27.07.00)	IMPORTANT NOTIFICATION
Applicant's or agent's file reference P/23694.WO/MWM	
International application No. PCT/GB99/03425	International filing date (day/month/year) 22 October 1999 (22.10.99)

1. The following indications appeared on record concerning:		
<input checked="" type="checkbox"/> the applicant	<input type="checkbox"/> the inventor	<input type="checkbox"/> the agent
<input type="checkbox"/> the common representative		
Name and Address TANDBERG TELEVISION LIMITED 35 Basinghall Street London EC2V 5DB United Kingdom	State of Nationality GB	State of Residence GB
	Telephone No.	
	Facsimile No.	
	Teleprinter No.	
2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:		
<input type="checkbox"/> the person	<input checked="" type="checkbox"/> the name	<input type="checkbox"/> the address
<input type="checkbox"/> the nationality		
<input type="checkbox"/> the residence		
Name and Address TANDBERG TELEVISION ASA 35 Basinghall Street London EC2V 5DB United Kingdom	State of Nationality GB	State of Residence GB
	Telephone No.	
	Facsimile No.	
	Teleprinter No.	
3. Further observations, if necessary:		
4. A copy of this notification has been sent to:		
<input checked="" type="checkbox"/> the receiving Office	<input type="checkbox"/> the designated Offices concerned	
<input type="checkbox"/> the International Searching Authority	<input checked="" type="checkbox"/> the elected Offices concerned	
<input checked="" type="checkbox"/> the International Preliminary Examining Authority	<input type="checkbox"/> other:	

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland	Authorized officer Mougamadou ABIDINE
Facsimile No.: (41-22) 740.14.35	Telephone No.: (41-22) 338.83.38

ATENT COOPERATION TREATY

PCT

NOTIFICATION OF THE RECORDING
OF A CHANGE(PCT Rule 92bis.1 and
Administrative Instructions, Section 422)

From the INTERNATIONAL BUREAU

To:

MOLYNEAUX, Martyn W.
Langner Parry
52-54 High Holborn
London WC1V 6RR
ROYAUME-UNI

Date of mailing (day/month/year) 05 July 2000 (05.07.00)	IMPORTANT NOTIFICATION
Applicant's or agent's file reference P/23694.WO/MWM	
International application No. PCT/GB99/03425	International filing date (day/month/year) 22 October 1999 (22.10.99)

1. The following indications appeared on record concerning:		
<input type="checkbox"/> the applicant	<input type="checkbox"/> the inventor	<input type="checkbox"/> the agent <input checked="" type="checkbox"/> the common representative
Name and Address TANDBERG TELEVISION LIMITED Anderson, Angela, Mary Gamma House Enterprise Road Chilworth Hampshire SO16 7NS United Kingdom	State of Nationality	State of Residence
	Telephone No. 44 1703 876030	
	Facsimile No. 44 1703 876035	
	Teleprinter No.	
2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:		
<input checked="" type="checkbox"/> the person	<input type="checkbox"/> the name	<input checked="" type="checkbox"/> the address <input type="checkbox"/> the nationality <input type="checkbox"/> the residence
Name and Address MOLYNEAUX, Martyn W. Langner Parry 52-54 High Holborn London WC1V 6RR United Kingdom	State of Nationality	State of Residence
	Telephone No. 44 207 242 5566	
	Facsimile No. 44 207 405 1908	
	Teleprinter No.	
3. Further observations, if necessary:		
4. A copy of this notification has been sent to:		
<input checked="" type="checkbox"/> the receiving Office	<input type="checkbox"/> the designated Offices concerned	
<input type="checkbox"/> the International Searching Authority	<input checked="" type="checkbox"/> the elected Offices concerned	
<input checked="" type="checkbox"/> the International Preliminary Examining Authority	<input type="checkbox"/> other:	

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No.: (41-22) 740.14.35	Authorized officer Juan Cruz Telephone No.: (41-22) 338.83.38
---	---

PATENT COOPERATION TREATY

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NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Assistant Commissioner for Patents
 United States Patent and Trademark
 Office
 Box PCT
 Washington, D.C.20231
 ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

Date of mailing (day/month/year) 05 July 2000 (05.07.00)	Applicant's or agent's file reference P/23694.WO/MWM
International application No. PCT/GB99/03425	
International filing date (day/month/year) 22 October 1999 (22.10.99)	Priority date (day/month/year) 23 October 1998 (23.10.98)
Applicant BEECH, Brian, Herbert et al	

1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International Preliminary Examining Authority on:
 22 May 2000 (22.05.00)

☐ in a notice effecting later election filed with the International Bureau on:

2. The election ☒ was
☐ was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland	Authorized officer Juan Cruz
Facsimile No.: (41-22) 740.14.35	Telephone No.: (41-22) 338.83.38

PATENT COOPERATION TREATY

PCT

From the INTERNATIONAL BUREAU

NOTIFICATION OF THE RECORDING
OF A CHANGE(PCT Rule 92bis.1 and
Administrative Instructions, Section 422)

To:

MOLYNEAUX, Martyn W.
Langner Parry
52-54 High Holborn
London WC1V 6RR
ROYAUME-UNI

Date of mailing (day/month/year) 22 November 2000 (22.11.00)	IMPORTANT NOTIFICATION
Applicant's or agent's file reference P/23694.WO/MWM	
International application No. PCT/GB99/03425	International filing date (day/month/year) 22 October 1999 (22.10.99)

1. The following indications appeared on record concerning:

☒ the applicant

 ☐ the inventor

 ☐ the agent

 ☐ the common representative

Name and Address

TANDBERG TELEVISION LIMITED
35 Basinghall Street
London EC2V 5DB
United Kingdom

State of Nationality

GB

State of Residence

GB

Telephone No.

Facsimile No.

Teleprinter No.

CORRECTED
VERSION

2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

☐ the person

 ☒ the name

 ☒ the address

 ☒ the nationality

 ☒ the residence

Name and Address

TANDBERG TELEVISION ASA
Philip Pedersens Vei 20
P.O. Box 322
N-1326 Lysaker
Norway

State of Nationality

NO

State of Residence

NO

Telephone No.

Facsimile No.

Teleprinter No.

3. Further observations, if necessary:

4. A copy of this notification has been sent to:

<input checked="" type="checkbox"/> the receiving Office	<input type="checkbox"/> the designated Offices concerned
<input type="checkbox"/> the International Searching Authority	<input checked="" type="checkbox"/> the elected Offices concerned
<input checked="" type="checkbox"/> the International Preliminary Examining Authority	<input type="checkbox"/> other:

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1211 Geneva 20, Switzerland

Authorized officer

Mougamadou ABIDINE

Facsimile No.: (41-22) 740.14.35

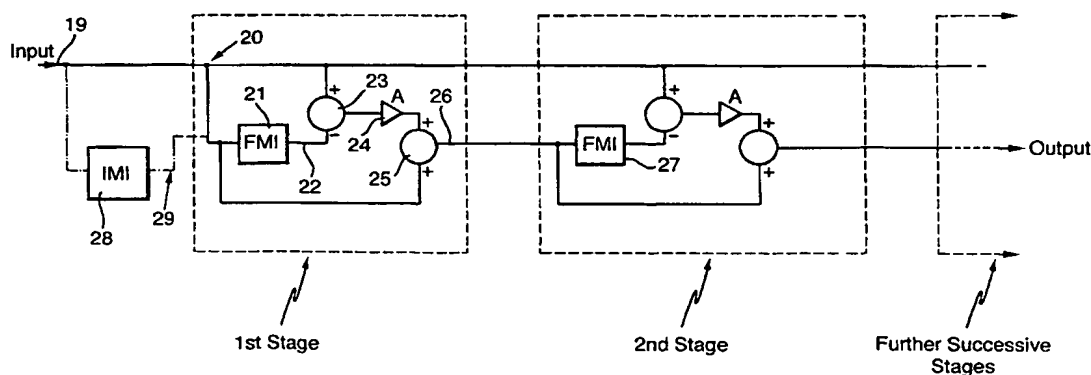
Telephone No.: (41-22) 338.83.38



INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁷ : H04L 27/36, H03F 1/32	A1	(11) International Publication Number: WO 00/25495 (43) International Publication Date: 4 May 2000 (04.05.00)
(21) International Application Number: PCT/GB99/03425 (22) International Filing Date: 22 October 1999 (22.10.99) (30) Priority Data: 9823190.5 23 October 1998 (23.10.98) GB (71) Applicant (for all designated States except US): TANDBERG TELEVISION LIMITED [GB/GB]; 35 Basinghall Street, London EC2V 5DB (GB). (72) Inventors; and (75) Inventors/Applicants (for US only): BEECH, Brian, Herbert [GB/GB]; 10 Darlington Road, Bishopstoke, Eastleigh, Hampshire SO50 0NF (GB). EDWARDS, David [GB/GB]; 36 Chatsworth Road, Boyatt Wood, Eastleigh, Hampshire SO50 4PE (GB). (74) Common Representative: TANDBERG TELEVISION LIMITED; Anderson, Angela, Mary, Gamma House, Enterprise Road, Chilworth, Hampshire SO16 7NS (GB).		(81) Designated States: JP, US, European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE). Published <i>With international search report.</i>

(54) Title: METHOD AND APPARATUS FOR REDUCING DISTORTION OF DIGITAL DATA



(57) Abstract

The invention relates to a method and apparatus for reducing the effects distortion experienced by a modulated signal carrying digital data during passage across a transmission link, and is particularly suited to satellite transmission links and especially those satellite transmission links intended for transmission of signals modulated in accordance with higher order modulation schemes. The invention provides method and apparatus capable of pre-correction of both static and dynamic distortion experienced by modulated signals during transmission. A method of pre-distortion a signal, modulated to carry symbols representative of digital data, so as to offset later distortion of the signal during transmission across a transmission link, the method comprising passing the signal through a cascade of pre-distorting stages, each of which generates an approximation of the required pre-distortion, each successive stage receiving the approximation from the preceding stage so that the errors in successive approximations converge. Apparatus for pre-distortion a signal, modulated to carry symbols representative of digital data, so as to offset later distortion of the signal during transmission across a transmission link, the apparatus comprising a cascade of pre-distorting stages, each of which generates an approximation of the required pre-distortion, each successive stage receiving the approximation from the preceding stage so that the errors in successive approximations converge.

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PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference 98-38 PCT	FOR FURTHER ACTION see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
International application No. PCT/GB 99/ 03425	International filing date (day/month/year) 22/10/1999	(Earliest) Priority Date (day/month/year) 23/10/1998
Applicant TANDBERG TELEVISION LIMITED et al.		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 3 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

- a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

- b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. ☐ **Certain claims were found unsearchable** (See Box I).

3. ☐ **Unity of invention is lacking** (see Box II).

4. With regard to the **title**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No.

☐ as suggested by the applicant.

☒ because the applicant failed to suggest a figure.

☐ because this figure better characterizes the invention.

2

☐ None of the figures.

INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 99/03425

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 H04L27/36 H03F1/32

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H04L H03F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 95 32561 A (ORTEL CORP.) 30 November 1995 (1995-11-30) page 7, line 9 - line 13 page 8, line 35 -page 9, line 3 figures 1,8 ---	1-25
X	US 4 992 754 A (LOBODA HOWARD L. ET AL.) 12 February 1991 (1991-02-12) column 3, line 27 - line 30 column 3, line 62 -column 4, line 27; figure 1 ---	1-24
A	--- -/--	25

☒ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

° Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- "&" document member of the same patent family

Date of the actual completion of the international search

24 January 2000

Date of mailing of the international search report

02/02/2000

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Orozco Roura, C

INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 99/03425

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	<p>WOLCOTT T J ET AL: "UPLINK-NOISE LIMITED SATELLITE CHANNELS" PROCEEDINGS OF THE MILITARY COMMUNICATIONS CONFERENCE (MILCOM), IEEE, 6 November 1995 (1995-11-06), page 717-721 XP000580915 New York, USA ISBN: 0-7803-2490-0 abstract figure 2A</p> <p>-----</p>	1-25

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/GB 99/03425

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
WO 9532561	A	30-11-1995	AU 708748 B	12-08-1999
			AU 2641895 A	18-12-1995
			CN 1151229 A	04-06-1997
			EP 0760184 A	05-03-1997
			JP 10500824 T	20-01-1998
			US 5798854 A	25-08-1998

US 4992754	A	12-02-1991	AU 645029 B	06-01-1994
			AU 6199590 A	14-03-1991
			CA 2024385 A,C	08-03-1991
			DE 69032831 D	28-01-1999
			DE 69032831 T	12-05-1999
			EP 0416622 A	13-03-1991
			ES 2125851 T	16-03-1999
			JP 1925165 C	25-04-1995
			JP 3179807 A	05-08-1991
			JP 6052816 B	06-07-1994
			US 5363056 A	08-11-1994
			US 5132639 A	21-07-1992
			US 5252930 A	12-10-1993

PATENT COOPERATION TREATY

PCT

REC'D 19 OCT 2000

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INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference P/23694.WO/MWM	FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/GB99/03425	International filing date (day/month/year) 22/10/1999	Priority date (day/month/year) 23/10/1998
International Patent Classification (IPC) or national classification and IPC H04L27/36		
Applicant TANDBERG TELEVISION LIMITED et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.



2. This REPORT consists of a total of 7 sheets, including this cover sheet.

- ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 18 sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☒ Certain defects in the international application
- VIII ☒ Certain observations on the international application

Date of submission of the demand 22/05/2000	Date of completion of this report 17.10.2000
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Keller, M Telephone No. +49 89 2399 8807 

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/GB99/03425

I. Basis of the report

1. This report has been drawn on the basis of (*substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments.*):

Description, pages:

1,6,10,12	as originally filed			
5	as received on	24/07/2000	with letter of	21/07/2000
2,2a,3,3a,4,7,7a, 8,8a,9,11	as received on	27/09/2000	with letter of	26/09/2000

Claims, No.:

1-19	as received on	27/09/2000	with letter of	26/09/2000
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Drawings, sheets:

1/13-8/13, 10/13-12/13	as originally filed			
9/13,13/13	as received on	24/07/2000	with letter of	21/07/2000

2. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:
- ☐ the drawings, sheets:

3. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

4. Additional observations, if necessary:

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/GB99/03425

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-19
	No:	Claims	
Inventive step (IS)	Yes:	Claims	1-19
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1-19
	No:	Claims	

2. Citations and explanations

see separate sheet

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

see separate sheet

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

see separate sheet

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/GB99/03425

With respect to SECTION V:

1. As far as the subject-matter claimed in the present set of claims can be understood (cf. clarity objections raised in SECTION VIII of this international preliminary examination report), the subject-matter of independent Claims 1 and 9 is deemed to meet the requirements of Article 33 (1).
- 1a. None of the documents of the international search report discloses in accordance with Claim 1,
a method of pre-distorting a signal of a satellite transmission link,
said signal being modulated to carry symbols representative of digital data, so as to offset later distortion of the signal during transmission across the satellite transmission link,
said link having root Nyquist bandpass filters in respective up and down links, the method including
 - passing the signal through a cascade of **identical** pre-distorting stages (12), each of which generates an approximation of the required pre-distortion, each successive stage receiving the approximation from the preceding stage so that errors in successive approximations converge toward zero with increase in the number of stages.
- 1b. Furthermore, none of the documents of the international search report discloses, in accordance with independent Claim 9,
a satellite transmission link (5 - 7)
including
 - root Nyquist bandpass filters (2, 10) in respective up and down links and
 - apparatus for pre-distortion of a signal (19),modulated to carry symbols representing digital data, so as to offset later distortion of the signal during transmission across said links,
the apparatus comprising
 - a cascade of **identical** pre-distorting stages (12),
each said stage having
 - means for generating an approximation of the required pre-distortion, and
 - each successive stage being connected to receive the approximation from the preceding stage so that the errors in successive approximations converge

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/GB99/03425

toward zero with increase in the number of stages.

- 1c. Hence, the subject-matter of independent Claims 1 and 9 is new and inventive. Therefore, the criteria of Article 33 (1) to (3) PCT are met.

With respect to SECTION VII:

According to Rule 5.1 (a)(iii) PCT, the description shall disclose the invention, as claimed, in such terms that the *technical problem* (even if not expressly stated as such) and its solution can be understood.

On page 2a, lines 14 and 15, it is said "*It is an object of the present invention to overcome at least some of the problems associated with the prior art.*"

This definition is so vague and insignificant that neither the technical problem nor its solution can be understood.

Therefore, the requirements of Rule 5.1 (a)(iii) PCT are not met.

In order to overcome this objection, the Applicant should clearly specify the problem(s) to be solved by the invention and the solution(s) as claimed.

With respect to SECTION VIII:

Independent Claims 1 and 9 do not meet the requirements of Article 6 PCT in that the matter for which protection is sought is not clearly defined.

Claim 1 claims a method of pre-distorting a signal.

Present Claim 1 claims "passing the signal through a cascade of identical pre-distorting states (12)". What is presumably meant, are "stages" instead of "states".

The method of Claim 1 consists of a **single** method step, i.e. *passing the signal through a cascade of identical pre-distorting stages, each of which generates an approximation of the required pre-distortion.*

Hence, it is generally unclear how the pre-distortion is exactly performed.

Moreover the method does not specify which part of the signal is pre-distorted (e.g. the phase, the amplitude, both parts, frequency etc.) and to which extent the signal is pre-distorted.

Claim 1 merely specifies that each pre-distorting stage generates an approximation of the required pre-distortion. However, it is open to doubt what this approximation is and how it is calculated.

Furthermore, Claim 1 attempts to define the subject-matter **in terms of the result to be achieved** (see page 13, lines 14 to 17; page 14, lines 28 to 31). In this instance, however, such a formulation is not tolerable because it seems possible to define the subject-matter in more concrete terms, viz. in terms how the effect is to be achieved.

Moreover, the addition "*each successive stage receiving the approximation from the preceding stage so that errors in successive approximations converge toward zero with increase in the number of stages.*" is imprecise in that a skilled person cannot derive exact instructions how to achieve the result expressed. The last sentence expresses nothing other than: "the more stages are used, the better the result will be".

Corresponding objections are valid for independent Claim 9.

It should be noted that clarity is of utmost importance for the purposes of formulating an opinion on the questions whether the claimed invention appears to be novel, to involve an inventive step and to be industrially applicable in view of their function in defining the matter for which protection is sought (cf. PCT Gazette, Section IV, III-4.1). Moreover, the subject-matter claimed should be clear from the wording of the claim alone (cf. PCT Gazette, Section IV, III-4.2). As a general rule, claims which attempt to define the invention, or a feature thereof, by a result to be achieved should be objected to (cf. PCT Gazette, Section IV, III-4.7).

The Applicant has stated, by reference to Guidelines Part C, Chapter 3, paragraph 4.7, that definition by result is permissible in order to provide the applicants with the scope of protection to which they deserve. Additionally, it has been submitted that in this particular case, the invention is not *solely* defined in terms of result (emphasis added).

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/GB99/03425

However, this view expressed by the Applicant is not shared by the examiner with respect to the PCT-Guidelines quoted above.

In order to partially overcome the clarity objections raised, the mathematical algorithm expressed in equations 1 to 3 (cf. pages 7 and 8 of the description) should be added to the specifications of Claims 1 and 9 as well as the basics of the so-called *dynamic distortion* described on page 9, first and second paragraph.

required signal prior to transmission, with the resultant error being subtracted from the amplifier output. This approach is only suitable for systems in which the pre-distorter and amplifier are co-located. Thus, where this technique is used for satellite transmission links the opportunity for introduction or modification of the pre-distorter to take account of changes in amplifier characteristics is severely limited.

Another technique is that of constellation pre-distortion, where the constellation points generated by the modulator are pre-distorted such that at the amplifier output the constellation points are located in their correct relative positions. This method is suitable only for transmission links that are memory-less. This precludes the use of this approach where pulse shaping takes place before non-linear amplification of the signal. Therefore, it is not suitable for those transmission links that include bandpass filtering of the signal.

Signal pre-distortion performed at the radio (RF), intermediate (IF) or base band frequencies is often carried out by application of an inverse function of the distortion to the signal as disclosed in WO-A-95132561 and US-A-4992754. This type of pre-correction generates out of band components, which are then carried through to the amplifier input. Where the amplifier has an input filter, as is common for amplifiers used in satellite transmission links, then these components may be removed from the signal which becomes the input to the amplifier. Thus, the distortion

2a

imposed by the amplifier will not be accurately corrected
as the amplifier input signal is not the entire transmitted
5 signal. This means that this form of pre-correction is not
effective for correction of amplifiers contained within
satellite transponders where the bandwidth of the incoming
signal is high in relation to the bandwidth of the
transponder. Additionally, for digital transmission using
10 higher order modulation schemes, this type of pre-
correction requires very high clocking rates in order to
generate the wide-band pre-distortion components.

It is an object of the present invention to overcome at
15 least some of the problems associated with the prior art.

According to this invention there is provided a method of pre-distorting a signal of a satellite transmission link, said signal being modulated to carry symbols representative of digital data, so as to offset later distortion of the signal during transmission across the satellite transmission link, said link having root Nyquist bandpass filters in respective up and down links, the method including passing the signal through a cascade of identical pre-distorting states, each of which generates an approximation of the required pre-distortion, each successive stage receiving the approximation from the preceding stage so that errors in successive approximations converge toward zero with increase in the number of stages.

According to a second aspect of this invention there is provided a satellite transmission link including root Nyquist bandpass filters in respective up and down links and apparatus for pre-distortion of a signal, modulated to carry symbols representing digital data, so as to offset later distortion of the signal during transmission across said links, the apparatus comprising a cascade of identical pre-distorting stages, each said stage having means for generating an approximation of the required pre-distortion, and each successive stage being connected to receive the approximation from the preceding stage so that the errors in successive approximations converge toward zero with increase in the number of stages.

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3a

The method and apparatus of this invention allows input of a complex signal at a rate as low as one sample per symbol to the pre-distorter, and generating at its output a complex signal which may be at the same rate. This means that implementation of the hardware is practical for systems operating at
5 higher symbol rates.

The method and apparatus of the invention are particularly suited to pre-distortion of a modulated signal which is subsequently transmitted through a satellite transmission link as it provides a ground based means of applying pre-distortion of the amplifier located on the satellite.

10 It is common for transmission links to include band pass filters between the means of modulating the signal and the amplifier. As is described above, such filters are known to remove at least substantial portions of any out of band components contained within a signal. Additionally, this invention provides accurate pre-distortion for transmission links having one or more
15 band pass filter regardless of the location of such filter(s). Satellite

transmission links commonly employ ground and satellite-based band pass filters.

5 The method and apparatus of this invention allows accurate pre-distortion for a transmission link carrying any constellation pattern and having any non-linear amplifier, irrespective of whether the link is memory-less or not.

10 This allows pre-distortion to be applied to a signal for subsequent transmission through a transmission link having a band pass filter at each of the transmitter and receiver ends of the link. Additionally, by taking past and future symbols of the signal into account, not only can the static positions of the constellation points be pre-distorted accurately to take account of the effects of passage through the non-linearity of the link, but also the effects of inter-symbol interference (i.e. smearing) are substantially reduced.

15

The invention will now be described by way of example only and with reference to the following figures:

20 Figure 1 is a schematic diagram of a satellite transmission system incorporating a satellite transmission link.

Figure 2 is a schematic diagram of a pre-distorter of the present invention.

25 Figure 3 is a schematic diagram of the distorting function FM1 of Figure 2.

25

Figure 4 is a representation of an ideal 16QAM constellation prior to transmission through a transmission link.

30 Figure 5 is a representation of the output from a receiving Nyquist filter corresponding to the transmission link input of Figure 4.

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Figures 6a to 6d show computer simulations of outputs from a receiving Nyquist filter when different numbers of successive approximation stages are used.

5 Figure 7 is a graphical comparison of Bit Error Rates of differing pre-distortion circumstances.

Figures 8a and 8b show the output of a receiver Nyquist filter for 32 QAM using a pre-distorter of the invention, and the
10 corresponding constellation at the input to a transmitter Nyquist filter respectively.

Figure 9 shows a computer simulation of the output spectrum of the pre-distorter in comparing it with the spectrum without
15 the use of pre-distortion.

Figure 10 is a schematic diagram of a feedback control loop.

In Figure 1 there is shown a satellite transmission link 1, having a root Nyquist
20 band-pass filter 2, IQ modulator 3 and up-converter 4 prior to a transmitter 5. The transmitter provides an uplink to a satellite 6, which in turn provides a downlink to a number of receivers, one of which is shown as receiver 7. The receiver end of the satellite transmission link 1 can be seen as a reverse of the transmission end, with the receiver 7 connected successively through a
25 down-converter 8, an IQ demodulator 9 and a root Nyquist band-pass filter 10.

During operation of the transmission link 1, an input base band frequency signal, being one which has been modulated by a particular technique and scheme such as 16 QAM and having I and Q complex components, is filtered
30 by the root Nyquist band-pass filter 2. It is usual to use Nyquist filtering within transmission links in order to constrain the bandwidth of the transmitted signal. Conveniently Nyquist filtering of the signal is conducted by root Nyquist filters placed at each of the transmitter and receiver ends of the

that in a practical implementation these signals could be in the form of either Cartesian or polar representation.

5 The input signal 19 to the pre-distorter 12 is fed from junction 20 to a forward model of a distorting function 21 representative of the distortion of the satellite transmission link to supply symbols representative of digital data for time = $t(1)$. The output 22 of this

10 forward model is input along with the input signal 19 (which is arranged to supply symbols representative of digital data for time = $t(1)$ by use of unshown delay apparatus) to summing node 23. The output of summing node 23 is scaled by a value A by multiplier 24. The output of

15 multiplier 24 is combined with input signal 19 (also arranged to supply symbols representative of digital data for time = $t(1)$ by use of unshown delay apparatus) to summing node 25 to provide an output 26 from the first stage of approximation. This output 26 is determined by

20 equation (1) given below.

$$\text{Output 26} = (\text{input 19}) * A - (\text{output 22}) * A + (\text{input 19})$$

25

$$\text{Output 26} = [(\text{input 19}) - (\text{output 22})] * A + (\text{input 19}) \quad \text{Equation 1}$$

$[(\text{input 19}) - (\text{output 22})]$ is the error which exists between output 22 and input 19, and therefore

30

$$\text{Output 26} = (\text{input 19}) - (\text{error} * A) \quad \text{Equation 2}$$

It will be understood that Output 26 concerns symbols representative of digital data for time = $t(1)$.

7a

Output 26 acts as the input to forward model 27 of the identical second stage of successive approximations, and is
5 the same as input 19 to the first stage, but modified by the error scaled by a factor A. It can be seen that the pre-distorter 12 generates an error for symbols representative of digital data for time= $t(1)$ in relation to the output of forward model 21 of the first stage of the
10 successive approximations but the correction to account for pre-distortion is applied in relation to the input to forward model 27 of the next stage. During passage of symbols representative of digital data for time= $t(1)$ through the second stage of successive approximation, the
15 first stage of successive approximation is

supplied at junction 20 with symbols representative of
digital data for time= $t(1+n)$ where n represents the
5 pipeline delay.

It can be shown that with a suitable choice of A the use of
successive approximations such as given in the pre-
distorter 12 of Figure 2 then the output of the pre-
10 distorted will converge towards zero error as more stages
of successive approximation are added. In practice, A is
chosen to achieve the highest convergence rate for a given
forward model distorting function. For a transmission link
such as that of Figure 1, then it has been found that six
15 stages of successive approximation strikes a reasonable
balance between convergence towards zero error and hardware
implementation of the pre-distorter. Optionally, pre-
distorter 12 may additionally include an initial
approximator 28. This initial approximator is arranged to
20 operate function $IM1$, which is a function arranged to
provide an output which is approximately the inverse of
forward model distorting function $FM1$ as implemented by
forward model distorting functions 21, 27 and their
equivalents in further successive stages. Where initial
25 approximator 28 is included within a pre-distorter 12, then
output 29 is provided as an input to distorting function 21
and instead of input 19 fed from junction 20. This is
arranged to ensure (through use of appropriate delays to
operate for symbols representative of digital data for
30 time= $t(1)$ as described above. Thus, equation (2) becomes

$$\text{Output } 26 = (\text{Output } 29) - \text{error} * A$$

Equation 3

8a

For pre-distortion of an amplifier such as a TWT, the initial approximator 28 may be a function which places the constellation points in the correct place for pre-
5 distortion but which does not dynamically change their position from symbol to symbol. This is known as a static pre-distortion. Using a static pre-distortion for a rough approximation substantially reduces the number of
10 successive approximation stages required. Typically one static correction stage plus three dynamic stages (implemented by passage through one successive approximation stage) is sufficient to attain the desired pre-distortion of a satellite transmission link such as
15 that of Figure 1.

20

25

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The distorting function ~~21 for~~ the transmission link 1 of Figure 1 may be of the form shown in Figure 3. This consists of a forward TWT model 30, with root Nyquist filters 31 and 32 placed before and after the model. It is the presence of the root Nyquist filters which enables the pre-distorter 12 to
5 correct for the signal transitions from one constellation point to another. The practical implementation of the root Nyquist filters enables the summation of scaled sample values. The sample values include both past and future samples. This is the mechanism that enables correction for the effects of distortion upon symbols which rely upon past and future symbols for their later
10 interpretation during demodulation, i.e. the dynamic distortion. When used in combination with successive approximation this allows for a substantial reduction in the effects of inter-symbol interference.

The method and apparatus of this invention can be adapted in the manner
15 exemplified in this embodiment so as not to generate out of band components. Instead, the non-linear correction components are folded back into the bandwidth of the signal, and thus provide accurate pre-distortion for transmission links having one or more band pass filters.

20 If it is required that the pre-distorter shall correct additionally for the uplink High Power Amplifier (HPA), then a forward HPA model can also be included in the forward model distorting function. Alternatively, a completely separate pre-distorter could be used.

As an example of the operation of a pre-distorter, some simulation results are
25 given in Figs 4 to 9. In this example $A=0.875 = 7/8$. The use of simple fractions with a binary denominator reduces hardware complexity. A Nyquist link with 35% roll-off factor is included.

Fig 4 shows an ideal 16QAM constellation to be transmitted with the corner
30 points placed at TWT saturation and Fig 5 shows the corresponding output from a typical TWT. The constellation points are displaced and additionally they are smudged due to the transition affects caused by the transmit Nyquist filter /TWT combination.

modulation schemes are inherently more susceptible to increased BER due to the decreasing distance between constellation points. Figure 7 thus demonstrates the significant increase in performance associated with use of the pre-distortion method and apparatus of this application.

5

32 QAM is particularly suited to pre-distortion in accordance with this invention because the corner points are missing and all the remaining points pre-correct well. Fig 8a shows the output from a satellite transmission link TWT with pre-distortion using 6 stages of dynamic pre-distortion only. $A=0.875$ and 35% roll off factor. The corner points that are missing would be at the saturation point of the TWT if they were present. Fig 8b shows the pre-distorter output, which is a 32QAM constellation to be transmitted through a satellite transmission link. Fig 9 shows the output spectrum from the uplink for the case with and without pre-distortion. It is clear that in both cases the spectrum follows the shape of the transmit Nyquist filter and the only difference is that the pre-distorted signal is about 4dB lower in power.

10
15

In the above description it has been assumed that the characteristics of the TWT are known and these parameters are programmed into the pre-distortion hardware.

20

Figure 10 illustrates a block diagram of a feedback control loop, which includes a satellite of satellite transmission link 1, for modification of the pre-distortion parameters of the forward model distorting function F_{M1} of Figure 3.

25

The pre-distorter 100 receives its control parameters from microprocessor 101. The required non-linear characteristics are generated by the microprocessor and are down-loaded into RAM in the pre-distorter. Two modes are possible. In the non-feedback mode, it is assumed that the parameters for a particular satellite are known and these are stored in memory 102. The accuracy of pre-distortion will be limited by the accuracy of these parameters.

30

CLAIMS:

- 5 1. A method of pre-distorting a signal (19) of a
satellite transmission link, said signal being modulated to
carry symbols representative of digital data, so as to
offset later distortion of the signal during transmission
across the satellite transmission link (5 - 7), said link
10 having root Nyquist bandpass filters (2, 10) in respective
up and down links, the method including passing the signal
through a cascade of identical pre-distorting states (12),
each of which generates an approximation of the required
pre-distortion, each successive stage receiving the
15 approximation from the preceding stage so that errors in
successive approximations converge toward zero with
increase in the number of stages.
2. The method of Claim 1, wherein the transmission link
20 (5 - 7) has a particular bandwidth and wherein the signal
is passed through a cascade of pre-distorting stages, each
of which generates an approximation of the required pre-
distortion within the said bandwidth.
- 25 3. The method of claim 1 or 2, wherein said signal (19)
is applied to a forward model (21) representative of the
distortion of the satellite transmission link (5 - 7), an
output of the forward model is added with said signal to
provide an error signal, said error signal is amplified and
30 further summed with said signal to provide an input to a
next succeeding stage.

4. The method of any preceding claim, wherein said signal is passed through an initial approximator prior to passage
5 through successive approximation stages.

5. The method of claim 4, wherein the initial approximator comprises a static pre-distortion approximation function.

10

6. The method of any preceding claim, wherein the signal is modulated in accordance with 16 QAM.

7. The method of any of claims 1 to 5, wherein the signal
15 is modulated in accordance with 32 QAM.

8. The method of any of claims 1 to 5, wherein the signal is modulated in accordance with 16 PSK.

20 9. A satellite transmission link (5 - 7) including root Nyquist bandpass filters (2, 10) in respective up and down links and apparatus for pre-distortion of a signal (19), modulated to carry symbols representing digital data, so as to offset later distortion of the signal during
25 transmission across said links, the apparatus comprising a cascade of identical pre-distorting stages (12), each said stage having means for generating an approximation of the required pre-distortion, and each successive stage being connected to receive the approximation from the preceding
30 stage so that the errors in successive approximations converge toward zero with increase in the number of stages.

10. A link according to claim 9, wherein the transmission link has a particular bandwidth, and wherein each pre-distorting stage is arranged to generate an approximation within the said bandwidth.

11. A link as claimed in claim 9 or 10, wherein each pre-distorting stage (12) includes a forward model (21) representative of the distortion of the satellite transmission link (5 - 7) arranged to receive said signal (19), a summer (23) for adding an output of said forward model with said signal to provide an error signal, an amplifier (24) for amplifying said error signal, and an output of said amplifier being applied to a further summer (25) for adding an output of said amplifier with said signal, wherein an output of said further summer (25) may be applied as input to a forward model (27) of a next succeeding stage.

20

12. A link as claimed in claim 9, wherein an initial approximator (28) is connected to provide input to a first of said pre-distorting stages.

25 13. A link as claimed in claim 12, wherein the initial approximator (28) comprises a static pre-distortion approximation model.

14. A link as claimed in any of claims 9 to 13, wherein the signal is modulated in accordance with 16 QAM.

30

16

15. A link as claimed in any of claims 9 to 13, wherein the signal is modulated in accordance with 32 QAM.

5

16. A link as claimed in any of claims 9 to 13, wherein the signal is modulated in accordance with 16 PSK.

17. A link as claimed in claim 9, wherein six successive approximation stages are provided.

10

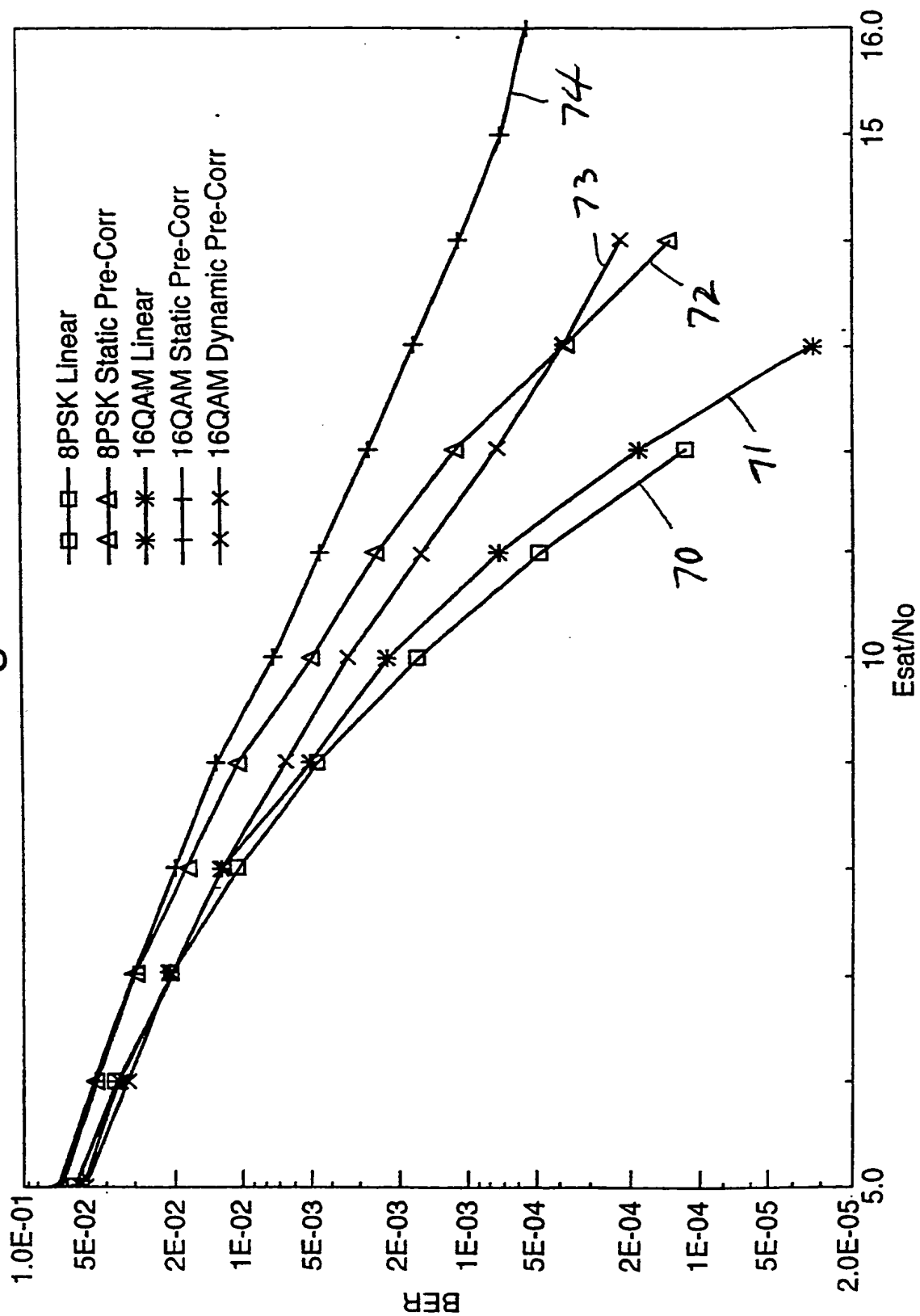
18. A link as claimed in claim 13, wherein one static pre-distortion and three successive approximation stages are provided.

15

19. A link as claimed in claim 9, wherein a feedback control loop is provided from the satellite transmission link to the cascade of pre-distorting stages.

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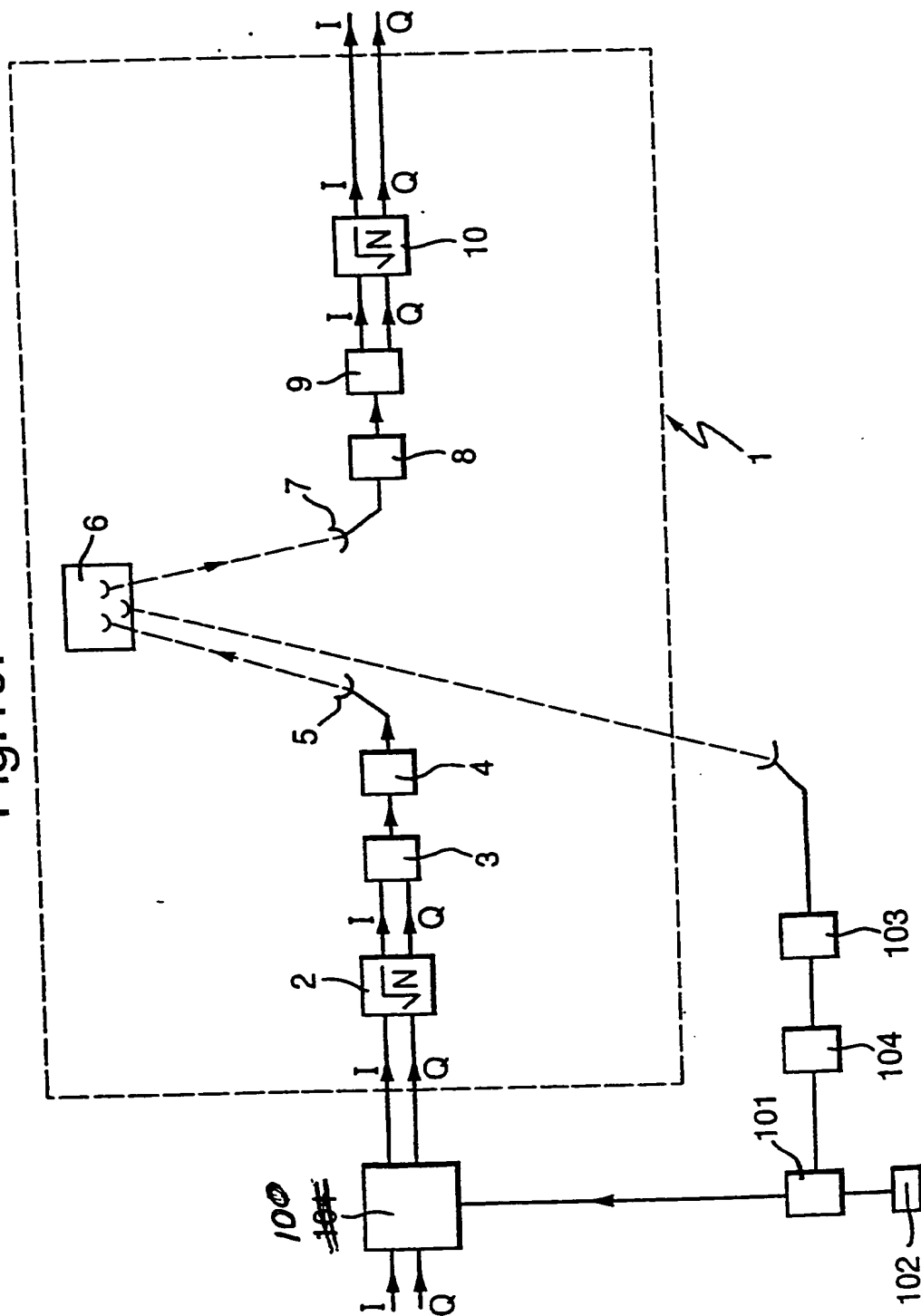
Fig.7.



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13/13

Fig.10.



PATENT COOPERATION TREATY

From the INTERNATIONAL SEARCHING AUTHORITY

PCT

To:

TANDBERG TELEVISION LIMITED
Attn. Anderson, Angela M.
Gamma House
Enterprise Road
Chilworth, Hampshire SO16 7NS
UNITED KINGDOM

NOTIFICATION OF TRANSMITTAL OF
THE INTERNATIONAL SEARCH REPORT
OR THE DECLARATION

(PCT Rule 44.1)

Date of mailing
(day/month/year)

02/02/2000

Applicant's or agent's file reference

98-38 PCT

FOR FURTHER ACTION

See paragraphs 1 and 4 below

International application No.

PCT/GB 99/03425

International filing date
(day/month/year)

22/10/1999

Applicant

TANDBERG TELEVISION LIMITED et al.

1. ☒ The applicant is hereby notified that the International Search Report has been established and is transmitted herewith.

Filing of amendments and statement under Article 19:

The applicant is entitled, if he so wishes, to amend the claims of the International Application (see Rule 46):

When? The time limit for filing such amendments is normally 2 months from the date of transmittal of the International Search Report; however, for more details, see the notes on the accompanying sheet.

Where? Directly to the International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland
Facsimile No.: (41-22) 740.14.35

For more detailed instructions, see the notes on the accompanying sheet.

2. ☐ The applicant is hereby notified that no International Search Report will be established and that the declaration under Article 17(2)(a) to that effect is transmitted herewith.

3. ☐ With regard to the protest against payment of (an) additional fee(s) under Rule 40.2, the applicant is notified that:

☐ the protest together with the decision thereon has been transmitted to the International Bureau together with the applicant's request to forward the texts of both the protest and the decision thereon to the designated Offices.

☐ no decision has been made yet on the protest; the applicant will be notified as soon as a decision is made.

4. **Further action(s):** The applicant is reminded of the following:

Shortly after **18 months** from the priority date, the international application will be published by the International Bureau. If the applicant wishes to avoid or postpone publication, a notice of withdrawal of the international application, or of the priority claim, must reach the International Bureau as provided in Rules 90bis.1 and 90bis.3, respectively, before the completion of the technical preparations for international publication.

Within **19 months** from the priority date, a demand for international preliminary examination must be filed if the applicant wishes to postpone the entry into the national phase until 30 months from the priority date (in some Offices even later).

Within **20 months** from the priority date, the applicant must perform the prescribed acts for entry into the national phase before all designated Offices which have not been elected in the demand or in a later election within 19 months from the priority date or could not be elected because they are not bound by Chapter II.

Name and mailing address of the International Searching Authority



European Patent Office, P.B. 5818 Patentlaan 2
NL-2280 HV Rijswijk
Tel. (+31-70) 340-2040. Tx. 31 651 epo nl.
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Authorized officer

Liliane Van Velzen-Peron

NOTES TO FORM PCT/ISA/220

These Notes are intended to give the basic instructions concerning the filing of amendments under article 19. The Notes are based on the requirements of the Patent Cooperation Treaty, the Regulations and the Administrative Instructions under that Treaty. In case of discrepancy between these Notes and those requirements, the latter are applicable. For more detailed information, see also the PCT Applicant's Guide, a publication of WIPO.

In these Notes, "Article", "Rule", and "Section" refer to the provisions of the PCT, the PCT Regulations and the PCT Administrative Instructions respectively.

INSTRUCTIONS CONCERNING AMENDMENTS UNDER ARTICLE 19

The applicant has, after having received the international search report, one opportunity to amend the claims of the international application. It should however be emphasized that, since all parts of the international application (claims, description and drawings) may be amended during the international preliminary examination procedure, there is usually no need to file amendments of the claims under Article 19 except where, e.g. the applicant wants the latter to be published for the purposes of provisional protection or has another reason for amending the claims before international publication. Furthermore, it should be emphasized that provisional protection is available in some States only.

What parts of the international application may be amended?

Under Article 19, only the claims may be amended.

During the international phase, the claims may also be amended (or further amended) under Article 34 before the International Preliminary Examining Authority. The description and drawings may only be amended under Article 34 before the International Examining Authority.

Upon entry into the national phase, all parts of the international application may be amended under Article 28 or, where applicable, Article 41.

When?

Within 2 months from the date of transmittal of the international search report or 16 months from the priority date, whichever time limit expires later. It should be noted, however, that the amendments will be considered as having been received on time if they are received by the International Bureau after the expiration of the applicable time limit but before the completion of the technical preparations for international publication (Rule 46.1).

Where not to file the amendments?

The amendments may only be filed with the International Bureau and not with the receiving Office or the International Searching Authority (Rule 46.2).

Where a demand for international preliminary examination has been/is filed, see below.

How?

Either by cancelling one or more entire claims, by adding one or more new claims or by amending the text of one or more of the claims as filed.

A replacement sheet must be submitted for each sheet of the claims which, on account of an amendment or amendments, differs from the sheet originally filed.

All the claims appearing on a replacement sheet must be numbered in Arabic numerals. Where a claim is cancelled, no renumbering of the other claims is required. In all cases where claims are renumbered, they must be renumbered consecutively (Administrative Instructions, Section 205(b)).

The amendments must be made in the language in which the international application is to be published.

What documents must/may accompany the amendments?

Letter (Section 205(b)):

The amendments must be submitted with a letter.

The letter will not be published with the international application and the amended claims. It should not be confused with the "Statement under Article 19(1)" (see below, under "Statement under Article 19(1)").

The letter must be in English or French, at the choice of the applicant. However, if the language of the international application is English, the letter must be in English; if the language of the international application is French, the letter must be in French.

NOTES TO FORM PCT/ISA/220 (continued)

The letter must indicate the differences between the claims as filed and the claims as amended. It must, in particular, indicate, in connection with each claim appearing in the international application (it being understood that identical indications concerning several claims may be grouped), whether

- (i) the claim is unchanged;
- (ii) the claim is cancelled;
- (iii) the claim is new;
- (iv) the claim replaces one or more claims as filed;
- (v) the claim is the result of the division of a claim as filed.

The following examples illustrate the manner in which amendments must be explained in the accompanying letter:

1. [Where originally there were 48 claims and after amendment of some claims there are 51]:
"Claims 1 to 29, 31, 32, 34, 35, 37 to 48 replaced by amended claims bearing the same numbers; claims 30, 33 and 36 unchanged; new claims 49 to 51 added."
2. [Where originally there were 15 claims and after amendment of all claims there are 11]:
"Claims 1 to 15 replaced by amended claims 1 to 11."
3. [Where originally there were 14 claims and the amendments consist in cancelling some claims and in adding new claims]:
"Claims 1 to 6 and 14 unchanged; claims 7 to 13 cancelled; new claims 15, 16 and 17 added." or
"Claims 7 to 13 cancelled; new claims 15, 16 and 17 added; all other claims unchanged."
4. [Where various kinds of amendments are made]:
"Claims 1-10 unchanged; claims 11 to 13, 18 and 19 cancelled; claims 14, 15 and 16 replaced by amended claim 14; claim 17 subdivided into amended claims 15, 16 and 17; new claims 20 and 21 added."

"Statement under article 19(1)" (Rule 46.4)

The amendments may be accompanied by a statement explaining the amendments and indicating any impact that such amendments might have on the description and the drawings (which cannot be amended under Article 19(1)).

The statement will be published with the international application and the amended claims.

It must be in the language in which the international application is to be published.

It must be brief, not exceeding 500 words if in English or if translated into English.

It should not be confused with and does not replace the letter indicating the differences between the claims as filed and as amended. It must be filed on a separate sheet and must be identified as such by a heading, preferably by using the words "Statement under Article 19(1)."

It may not contain any disparaging comments on the international search report or the relevance of citations contained in that report. Reference to citations, relevant to a given claim, contained in the international search report may be made only in connection with an amendment of that claim.

Consequence if a demand for international preliminary examination has already been filed

If, at the time of filing any amendments under Article 19, a demand for international preliminary examination has already been submitted, the applicant must preferably, at the same time of filing the amendments with the International Bureau, also file a copy of such amendments with the International Preliminary Examining Authority (see Rule 62.2(a), first sentence).

Consequence with regard to translation of the international application for entry into the national phase

The applicant's attention is drawn to the fact that, where upon entry into the national phase, a translation of the claims as amended under Article 19 may have to be furnished to the designated/elected Offices, instead of, or in addition to, the translation of the claims as filed.

For further details on the requirements of each designated/elected Office, see Volume II of the PCT Applicant's Guide.

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference 98-38 PCT	FOR FURTHER ACTION see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
International application No. PCT/GB 99/ 03425	International filing date (day/month/year) 22/10/1999	(Earliest) Priority Date (day/month/year) 23/10/1998
Applicant TANDBERG TELEVISION LIMITED et al.		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 3 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

- a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

- b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing:

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. ☐ **Certain claims were found unsearchable** (See Box I).

3. ☐ **Unity of Invention is lacking** (see Box II).

4. With regard to the **title**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No.

☐ as suggested by the applicant.

☒ because the applicant failed to suggest a figure.

☐ because this figure better characterizes the invention.

2
☐ None of the figures.

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:

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PCT

NOTIFICATION OF TRANSMITTAL OF
THE INTERNATIONAL PRELIMINARY
EXAMINATION REPORT
(PCT Rule 71.1)

Date of mailing
(day/month/year) 17.10.2000

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IMPORTANT NOTIFICATION

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Applicant
TANDBERG TELEVISION LIMITED et al.

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.
2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.
3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.

4. REMINDER

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices) (Article 39(1)) (see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

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